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formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region; and

an electrode formed on said metal-containing insulating film.

REMARKS

In this Amendment, Applicants amend claim 12 in order to more appropriately define the present invention. In accordance with the requirements of 37 C.F.R. § 1.121(c)(1), Applicants provide a marked-up version of the amended claim in an attached Appendix designated "Version of Claim with Markings to Show Changes Made." Upon entry of this Amendment, claims 1 – 20 remain pending, with claims 1 – 11, 19, and 20 withdrawn from consideration as drawn to a nonelected invention.

In the Office Action, the Examiner objected to Applicants' disclosure for informalities; rejected claims 12 – 16 under 35 U.S.C. § 112, 1st paragraph; rejected claim 12 under 35 U.S.C. § 112, 2nd paragraph; rejected claims 12 – 16 under 35 U.S.C. § 103(a) as unpatentable over Hu, et al. (U.S. Patent No. 5,962,904) and Wittmer, et al., Oxidation Kinetics of TiN Thin Films, J. Appl. Phys. 52(11), pp. 6659 – 6664 (1981), and further in view of Nakajima, et al. (U.S. Patent No. 5,907,188); and allowed claims 17 and 18. Applicants acknowledge with appreciation the Examiner's indication that claims 17 and 18 are drawn to allowable subject matter.

Procedural Issues:

Applicants mention the following procedural issues to ensure that a complete response is made to the Office Action and to clarify the written record.

First, the Examiner incorrectly indicated, on the Office Action Summary page (Form PTO-326), that the Office Action was responsive to a communication "filed on 28 August 2002."

Applicants did not file any communication with the Office on August 28th. Applicants filed the last communication with the Office on August 21, 2002.

Second, the Examiner incorrectly indicated, on page 2, line 7, of the Office Action, that Applicants filed a request on "8/26/2002." Again, Applicants point out that the last communication was filed on August 21, 2002. *The paper was filed in 2002 on 8/21/02 in continuity of application*

Regarding the Objection to Applicants' Specification:

The Examiner objected to Applicants' disclosure "because of the following informalities: The first line of page 1 of the instant specification must show that the current application is a RCE of the parent case 09/492, 780 filed January 28, 2000. Appropriate correction is required" (Office Action, page 3). Applicants submit that this "requirement" is wholly unfounded, as there is no requirement to list the filing of a RCE anywhere in the specification. The RCE merely reopened prosecution of the present application. As such, in the present case, there is no such thing as "parent case 09/492, 780" unless a divisional or other continuation application had been filed, which is not the case here. Applicants therefore deem the Examiner's requirement as being erroneous, and request withdrawal of the objection.

Rejection of Claims 12 – 16 under 35 U.S.C. § 112, 1st ¶:

Applicants respectfully traverse the rejection of claims 12 – 16 under 35 U.S.C. § 112, 1st ¶. Applicants take note of the Examiner's allegation that "the same is not supported by the original specification as filed" (Office Action, p. 3), and submit that the Examiner's allegations are unfounded.

In response, Applicants direct the Examiner's attention to the specification, for example, at page 4, ll. 8 – 15 and ll. 20 – 26 for direct support for the recitations of Applicants' claim 12.

Applicants respectfully point out to the Examiner that:

“[p]rior to determining whether the disclosure satisfies the written description requirement for the claimed subject matter, the examiner should review the claims and the entire specification ... to understand how applicant provides support for the various features of the claimed invention. ... *The analysis of whether the specification complies with the written description requirement calls for the examiner to compare the scope of the claim with the scope of the description to determine whether applicant has demonstrated possession of the claimed invention.*” M.P.E.P. § 2163(II)(A)(2), p. 2100-160, emphasis added, citations omitted.

See also M.P.E.P. § 2163.02, p. 2100-167 (“An applicant shows possession of the claimed invention by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention”).

Applicants submit that for the reasons presented above, the language of claim 12 and the corresponding description in the specification clearly indicates Applicants’ possession of the claimed invention to satisfy the requirements of 35 U.S.C. § 112, 1st paragraph. Applicants submit that all subject matter in “the specification conveys with a reasonable clarity to those skilled in the art that, as of the filing date sought, applicant[s] [were] in possession of the invention as now claimed” (M.P.E.P. § 2163, 8th Ed., p. 2100-158), and that Applicants have fully satisfied their burden to “show support in the original disclosure for the new or amended claims” (Id., p. 2100-159).

Claim 12 fully complies with the requirements of 35 U.S.C. § 112, 1st paragraph, and Applicants accordingly request withdrawal of that rejection.

In making various references to the specification and drawings set forth herein, it is understood that Applicants are in no way intending to limit the scope of the claims to the

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exemplary embodiments described in the specification and illustrated in the drawings. Rather, Applicants expressly affirm that they are entitled to have the claims interpreted broadly, to the maximum extent permitted by statute, regulation, and applicable case law.

Rejection of Claim 12 under 35 U.S.C. § 112, 2nd ¶:

Regarding the rejection of claim 12 under 35 U.S.C. § 112, 2nd paragraph, Applicants have amended claim 12 to more clearly define the present invention and to address the Examiner's concerns. Applicants therefore respectfully deem the rejection of claim 12 overcome, as the Examiner stated "the proper placement and relationship between the second insulating region and the other elements may be recited to over come this rejection" (Office Action, p. 4). Claim 12, along with pending claims 13 – 18, fully complies with the requirements of 35 U.S.C. § 112, 2nd paragraph, and Applicants accordingly request withdrawal of that rejection.

Rejection of Claims 12 – 16 under 35 U.S.C. § 103(a):

Applicants respectfully traverse the rejection of claims 12 – 16, as detailed above, for the following reasons. Applicants respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established, and do not concede to the Examiner's claim that he "has established *prima facie* obviousness beyond a shadow of doubt" (Office Action, p. 8).

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Furthermore, "[a]ll words in a claim must be considered in judging the patentability of that claim against the prior art." *See M.P.E.P. § 2143.03, 8th Ed., Aug. 2001, p. 2100-126,* quoting *In re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Second, there must be some

suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. *See M.P.E.P. § 2143, pp. 2100-122 – 127.*

The Examiner does not show that all the elements of Applicants' claims are met in the cited references, taken alone or in combination (and thus "every limitation presently recited has" not in fact "been shown to be *prima facie* obvious" (Office Action, p. 8)), does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

Applicants' claim 12 recites a combination of elements, including, *inter alia*,

"a metal-containing insulating film formed directly or indirectly on said semiconductor substrate, said metal-containing insulating film including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region."

Hu and/or Wittmer do not teach or suggest at least these recitations of Applicants' claim 12. In contrast, Hu discloses a 9 nm gate oxide layer 14, poly-Si layer 16, electrically conductive Si material (preferably refractory metal Si-nitride and also amorphous (Hu, col. 5, ll. 59-60)) as a diffusion barrier 18, a W / W_xSi_y electrode layer 20, and a cap 34. While the Examiner admits that "Hu and Wittmer do not specifically describe the limitation[," i]ncluding a plurality of first insulating regions each of which is formed of a grain containing a metal oxide["]" (Office Action, p. 5), the combination with Nakajima still does not teach or suggest at least the

recitations of Applicants' claim 12 as discussed above. It is clear that Hu, Wittmer, and Nakajima, taken alone or in combination, do not teach or suggest all of the recitations of Applicants' claim 12. In part, this is because Hu's only insulating film is gate oxide layer 14 (Figure 4), while Hu's remaining film layers are either semiconducting (poly-Si layer 16) or electrically conductive (diffusion barrier 18 and W / W_xSi_y electrode layer 20). Hu clearly does not teach or suggest a plurality of first insulating regions.

Furthermore, Applicants again respectfully submit that the Examiner has incorrectly paraphrased Applicants' claim 12 when he applied the Nakajima reference. The Examiner alleged that "the Nakajima reference ... in figs. 31 A –I and col. 31 lines 3 to col. 32 line 50 describes a CMOSFET having a plurality of first insulating regions each of which is formed of a grain containing a metal oxide to from [sic] the CMOS device" (Office Action, p. 5). Applicants submit that the Examiner did not address the remaining portion of the same recitation in Applicants' claim 12. This recitation properly states, "a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material." Nowhere in Nakajima—let alone in col. 31 lines 3 to col. 32 line 50 (as alleged by the Examiner)—is there any teaching or suggestion of "a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region formed of an amorphous insulating material," as in Applicants' claim 12. Nakajima merely discloses insulating layers formed during device fabrication processes (none of which are labeled "first insulating regions"), and discloses nothing regarding the contents of grains in an insulating region as Applicants have recited in their claim.

Even though Nakajima does not teach or suggest all the features of Applicants' claimed invention, the Examiner's application of Nakajima as a reference, in addition to Hu and/or

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Wittmer, does not render the recitations of Applicants' claims obvious. Even considering the Examiner's incorrect construal of Applicants' present claimed invention, this still does not establish that there would have been the requisite suggestion or motivation in Nakajima to modify the reference to teach or suggest Applicants' claimed invention. Applicants respectfully point out to the Examiner that it "is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *See In re Wesslau*, 147 U.S.P.Q. 391 (C.C.P.A. 1965). *See also* M.P.E.P. § 2141.02, p. 2100-120.

Moreover, while the Examiner alleges "it would have been obvious to one of ordinary skill in the art at the time of the invention to include Nakajima's plurality of first insulating regions each of which is formed of a grain containing a metal oxide in Hu and Wittmer's device to form a CMOS.device" (Office Action, p. 5), Wittmer and/or Nakajima, taken alone or in combination, still do not cure the deficiencies of Hu. Wittmer's "investigat[ion of] the oxidation kinetics of TiN thin films dry O₂ in view of possible application of TiN as the material for gate electrodes" (Wittmer, Abstract) still does not teach or suggest the recitations of Applicants' invention not taught or suggested by Hu. Since Hu, Wittmer, and Nakajima, taken alone or in combination, do not teach or suggest at least the above-mentioned elements of Applicants' claim 12, the Examiner's application of Hu, Wittmer, and Nakajima as references to formulate an obviousness rejection under 35 U.S.C. § 103(a) is improper.

*(CMOS
Hu
Nakajima)*

The Examiner has therefore not met the essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." *See* M.P.E.P. §§ 2142, 2143, and 2143.03.

Furthermore, there is no suggestion or motivation to modify Hu with Wittmer and/or Nakajima to produce Applicants' claimed invention. Even the Examiner's characterization of the references still does not establish that there would have been the requisite suggestion or motivation to modify Hu with Wittmer and/or Nakajima. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Because Hu, Wittmer, and Nakajima *cannot* be modified to produce Applicants' invention, their resultant combination cannot be obvious, since, for the reasons presented above, it does not produce Applicants' claimed invention. Likewise, there cannot be any expectation of success from so doing, because combining the references still would not produce Applicants' claimed invention.

In addition, the M.P.E.P. states "[a] statement [by the Examiner] that modifications of the prior art to meet the claimed invention would have been "well within the ordinary skill of the art at the time the invention was made" because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references." M.P.E.P. § 2143.01, p. 2100-124 (citations omitted, emphasis in original). Because Applicants have already established that Hu, Wittmer, and Nakajima cannot be modified to produce the present invention, Applicants submit that, according to the M.P.E.P., the Examiner's citation of Hu, Wittmer, and Nakajima is not sufficient to establish *prima facie* obviousness over Applicant's claims 12 – 16.

As further evidence of the impropriety of a combination of Hu, Wittmer, and Nakajima (thus demonstrating additional lack of motivation to combine, and that there is no reasonable

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expectation of success to be drawn from combining the references), Applicants point out that their claimed metal-containing insulating film includes a plurality of first insulating regions and a second insulating region. Each of the first insulating regions is formed of a grain containing a metal oxide. The metal oxide has a high dielectric constant, thus increasing the dielectric constant of the metal-containing insulating film. If the metal-containing insulating film were formed only of grains of metal oxide, leakage current would flow along the grain boundary. However, in the present invention, the second insulating region is formed of an amorphous insulating material, and each of the first insulating regions is formed in the second insulating region. The first insulating regions are therefore isolated from each other by the second insulating region, thus preventing the above leakage current. In contrast, Hu, Wittmer, and Nakajima each simply disclose a structure of stacked films. These references, taken singly or together, do not produce the claimed device of the present invention.

No relevance

Applicants also contest the Examiner's allegation that "[i]t would have been obvious to one of ordinary skill in the art ... to include Nakajima's plurality of first insulating regions ... in Hu and Wittmer's device[s] to form a CMOS.device." (Office Action, p. 5), as Applicants have already demonstrated herein that the cited references do not teach or suggest each and every element of Applicants' independent claim 12. The Examiner's statement remains an unsubstantiated generalization of questionable relevance to claim 12. The Examiner responded to this by noting that he "did not specify common knowledge/ Official notice was taken and therefore [A]pplicants' arguments based on hypothetical assumption need not be dealt with in great detail" (Office Action, p. 8). Applicants submit that the Examiner has introduced statements on the record without documentary evidence or other factual bases to support them, and therefore Applicants did not just present a "hypothetical assumption." Applicants continue

to contest the Examiner's statements, and should the Examiner maintain the rejection after considering the arguments presented herein, Applicants submit that the Examiner must provide the explicit basis on which the Examiner seeks to rely in the form of documentary or other factual evidence to support his position, or else withdraw the rejection.

Finally, Applicants traverse the Examiner's statement that "[i]t is noted that in response to applicants' arguments set out in page 7 every limitation presently recited has been shown to be *prima facie obvious above*" (Office Action, p. 8). The arguments presented herein clearly demonstrate the impropriety of the Examiner's allegation.

Applicants have demonstrated herein that the Examiner: (a) has not shown all recitations of Applicants' claimed invention are taught or suggested by Hu, Wittmer, and Nakajima; (b) has not shown any requisite motivation to modify Hu, with Wittmer and/or Nakajima to produce Applicants' claimed invention; and (c) has not shown there would be any reasonable expectation of success from modifying Hu, Wittmer, and Nakajima in order to produce the present claimed invention.

Regarding dependent claims 13 – 16,

"Examiners are reminded that a dependent claim is directed to a combination including everything recited in the base claim and what is recited in the dependent claim. It is this combination that must be compared with the prior art, exactly as if it were present as one independent claim." M.P.E.P.

§ 608.01(n)(III), p. 600-77. "If an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P.
§ 2143.03, p. 2100-26.

Therefore, Applicants submit that independent claim 12 is allowable, for the reasons argued above. In addition, dependent claims 13 – 16 are also allowable at least by virtue of their

dependency from allowable base claim 12. Therefore, Applicants respectfully submit that the Examiner should withdraw the 35 U.S.C. § 103(a) rejection.

Conclusion:

In view of the foregoing, Applicants request the Examiner's reconsideration of the application and submit that the rejections detailed above are improper and should be withdrawn. Applicants submit that independent claim 12 is in condition for allowance as are dependent claims 13 – 16, in addition to already-allowed claims 17 and 18. A favorable action is requested.

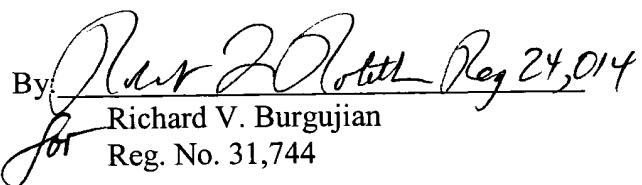
Should the Examiner continue to dispute the patentability of the claims after consideration of this Amendment, Applicants invite the Examiner to contact Applicants' undersigned representative by telephone to discuss any remaining issues.

Please grant any extensions of time under 37 C.F.R. § 1.136 required in entering this response. If there are any fees due under 37 C.F.R. § 1.16 or 1.17, which are not enclosed, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: January 30, 2003

By: 
Richard V. Burgujian
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APPENDIX TO AMENDMENT of January 31, 2003

“VERSION OF CLAIM WITH MARKINGS TO SHOW CHANGES MADE”

AMENDMENTS TO THE CLAIM:

Please amend claim 12 as follows:

12. (Three Times Amended) A semiconductor device, comprising:
a semiconductor substrate;
a metal-containing insulating film formed directly or indirectly on said semiconductor substrate, said metal-containing insulating film including a plurality of first insulating regions each of which is formed of a grain containing a metal oxide and a second insulating region[, said second insulating region] formed of an amorphous insulating material, each of said first insulating regions being formed in said second insulating region; and

an electrode formed on said metal-containing insulating film.

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